

# Maxim Makatchev

Carnegie Mellon University  
Pittsburgh, PA 15213  
✉ maxi@cmu.edu  
📄 cs.cmu.edu/~mmakatch  
🌐 maxipesfix

## Software development skills

Languages Scala, Python, C++, C, Lisp, CLIPS, Pascal, Forth  
Scripting SQL, XML, PHP  
Scientific R, Matlab  
Frameworks ROS, Play!, sbt

## Positions held

- 3.2013–now **Post-doctoral fellow**, *Robotics Institute*, Carnegie Mellon University, Pittsburgh, PA.  
5.2010–8.2010 **Assistant to chief scientist**, *Alelo*, Los Angeles, CA.  
8.2007 **Visiting researcher**, *National Institute of Informatics*, Tokyo, Japan.  
5.2007–7.2007 **Summer scholar**, *Intel Research*, Pittsburgh, PA.  
10.2000–8.2006 **Research associate, Research programmer**, *University of Pittsburgh*, Pittsburgh, PA.  
11.1997–3.1998 **Research assistant**, *City University of Hong Kong*, Hong Kong.  
10.1995–10.1997 **Assistant to chief specialist**, *Acron, Joint Stock Company*, Moscow, Russia.

## Education

- 2006–2013 **PhD in Robotics**, *Carnegie Mellon University*, Pittsburgh, PA.  
1998–2001 **MPhil in Mechatronic Engineering**, *City University of Hong Kong*, Hong Kong.  
1992–1997 **Diploma (~MSc) in Applied Mathematics**, *Moscow State University*, Moscow.  
Graduated with distinction (QPA 4.86/5, major QPA 4.93/5)

## Experience

- 3.2013–now **Post-doctoral fellow**, *Robotics Institute*, Carnegie Mellon University, Pittsburgh, PA.  
Project: Gamebot Victor
- PI: Reid Simmons
  - Development of an interaction manager that controls the robot's verbal and non-verbal behaviors, including the robot's contributions to a conversation with a human user and the gameplay of Scrabble.
- 8.2006–2.2013 **PhD student**, *Robotics Institute*, Carnegie Mellon University, Pittsburgh, PA.  
Advisor: Reid Simmons
- Thesis committee: Michael Agar, Justine Cassell, Illah Nourbakhsh, and Candace Sidner.
  - Thesis: Cross-cultural believability of robot characters.
  - Expressing ethnicity of a robot character via verbal and non-verbal behaviors, social engagement [1], [3]–[10].

- Advisor: Daniel Neill
- Project: Machine learning for anomaly detection in spatio-temporal data.
  - Extended spatial scan statistics to incorporate learning [11].
- 5.2010–8.2010 **Assistant to chief scientist**, *Alelo*, Los Angeles, CA.  
Project: CultureCom
- Collaborators: Alicia Sagae, Suzanne Wertheim, Mike Agar, Jerry Hobbs and Lewis W. Johnson.
  - Developed a dialogue manager for culturally-specific interaction.
- 8.2007 **Visiting researcher**, *National Institute of Informatics*, Tokyo, Japan.  
Project: Mining of instant messaging data.
- Collaborators: Shinichi Honiden, Nik Nailah Binti Abdullah, Honiden Lab (U. of Tokyo/NII)
  - Developed dialogue act predictors and estimated the size of necessary context.
- 5.2007–7.2007 **Summer scholar**, *Intel Research*, Pittsburgh, PA.  
Project: Applying Spatial Scan Statistics for Network Intrusion Detection.
- Collaborators: Denver Dash, Distributed Detection and Inference (DDI).
  - Developed metrics relevant for network data and applied spatial scan statistics to detect slow worm attacks.
- 9.2006–4.2007 **V-Unit participant**, *Carnegie Mellon University*, Pittsburgh, PA.  
BlindAid: Spoken Language Interaction for Indoor Navigation Assistant.
- Collaborators: Sandra Mau, Nik Melchior, Aaron Steinfeld.
  - Interaction design for a handheld navigation aid for the visually impaired [12].
- 10.2000–8.2006 **Research associate, Research programmer**, *University of Pittsburgh*, Pittsburgh, PA.  
Why2-Atlas: A Dialogue-Based Explanation Tutoring System.
- Collaborators: Pamela Jordan, Kurt VanLehn, Umarani Pappuswamy, Carolyn Rosé.
  - Implemented symbolic (ATMS [19], abductive reasoning-based [2], [14]–[18], [20]–[26], and statistical (Bayesian networks [13]) systems for deep natural language understanding in a dialogue-based tutoring system.
- 3.1998–10.2000 **Research student (MPhil)**, *City University of Hong Kong*, Hong Kong.  
Advisors: S. K. Tso, Sherman Y. T. Lang
- Thesis: Computational Issues on Design and Implementation of an Autonomous Guided Vehicle.
  - Wrote motion control software for a four-wheel-steering mobile robot [28, 29].
  - Designed and implemented an agent-based human-robot interface via the internet, an XML-based markup language/ontology (RoboML) [27].
- 11.1997–3.1998 **Research assistant**, *City University of Hong Kong*, Hong Kong.  
Project: Design and Implementation of a Self-Navigation and Intelligent Control System for an Autonomous Guided Vehicle.
- Collaborator: Sherman Y. T. Lang
  - Investigated complexity of tessellation automata-based image processing [30].
  - Extended a dynamic model of a four-wheel-steering mobile robot with tire-ground contact forces (Matlab).
- 1992–1997 **Diploma (~MSc) in Applied Mathematics**, *Moscow State University*, Moscow.  
Advisor: V. N. Kozlov
- Thesis: On a Tessellation-based Model of Mammalian Visual System
  - Derived metric and complexity properties of a class of tessellation automata.

- 9.1995–8.1996 **Intern**, *Robotics Laboratory, Institute of Mechanics, Moscow State University*, Moscow.  
Project: Machine Vision System for the Six-legged Walking Robot MASCHA.
  - PI: E. A. Devjanin
  - Filtering and feature extraction for active and passive robot vision systems.
- 10.1995–10.1997 **Assistant to chief specialist**, *Acron, Joint Stock Company*, Moscow, Russia and Geneva, Switzerland.  
Chief specialist: Dmitry Demin
  - Duties: RDBMS development, liason with intranet contractors.

## Teaching

### Carnegie Mellon University

Spring 2009 Teaching assistant: 15-451, Algorithms (Manuel Blum)

### City University of Hong Kong

Spring 2000 Teaching assistant: Engineering mechanics

Fall 1999 Teaching assistant: Control principles and applications

Spring 1999 Instructor: Basic mechanics labs

Fall 1998 Instructor: Automation technology labs

Spring 1998 Instructor: Control engineering labs

## Graduate coursework (CMU)

Machine learning; Computational complexity; Optimization; Statistical machine learning; Probabilistic graphical models; Machine learning theory; Intermediate statistics; Kinematics, dynamics and control; Computer vision; Technically speaking; Gadgetry.

## Publications

### Journal

- [1] R. Simmons, M. Makatchev, R. Kirby, M.K. Lee, I. Fanaswala, B. Browning, J. Forlizzi, and M. Sakr. Believable robot characters. *AI Magazine*, 32(4):39–52, 2011.
- [2] Maxim Makatchev, Pamela W. Jordan, and Kurt VanLehn. Abductive theorem proving for analyzing student explanations to guide feedback in intelligent tutoring systems. *Journal of Automated Reasoning*, 32:187–226, 2004.

### Natural language dialogue

- [3] Maxim Makatchev, Reid Simmons, and Majd Sakr. A cross-cultural corpus of annotated verbal and nonverbal behaviors in receptionist encounters. In *Proceedings of Workshop on Gaze in HRI: From Modeling to Communication*, Boston, MA, March 2012.
- [4] Maxim Makatchev and Reid Simmons. Perception of personality and naturalness through dialogues by native speakers of American English and Arabic. In *Proc. of SIGDIAL*, Portland, OR, USA, 2011.

## ■ Human-robot dialogue

- [5] Maxim Makatchev, Reid Simmons, Majd Sakr, and Micheline Ziadee. Expressing ethnicity through behaviors of a robot character. In *Proc. of the 8th ACM/IEEE Int. Conf. on Human-robot interaction, HRI'13*, pages 357–364, Tokyo, Japan, 2013.
- [6] Maxim Makatchev and Reid Simmons. Do you really want to know? Display questions in human-robot dialogues. In *Proc. of AAAI Fall Symposium on Dialog with Robots*. AAAI Press, November 2010.
- [7] Maxim Makatchev, Imran Aslam Fanaswala, Ameer Ayman Abdulsalam, Brett Browning, Wael Mahmoud Gazzawi, Majd Sakr, and Reid Simmons. Dialogue patterns of an arabic robot receptionist. In *Proc. of the Int. Conf. on Human-Robot Interaction (HRI)*, pages 167–168. ACM, 2010.
- [8] Maxim Makatchev and Reid Simmons. Incorporating a user model to improve detection of unhelpful robot answers. In *Proc. of RO-MAN*, Toyama, Japan, September–October 2009.
- [9] Min Kyung Lee and Maxim Makatchev. How do people talk with a robot? An analysis of human-robot dialogues in the real world. In Richard B. Arthur Dan R. Olsen Jr., editor, *Proc. of CHI*, pages 3769–3774. ACM, April 2009.
- [10] Maxim Makatchev, Min Kyung Lee, and Reid Simmons. Relating initial turns of human-robot dialogues to discourse. In *Proc. of the Int. Conf. on Human-Robot Interaction (HRI)*, pages 321–322. ACM, 2009.

## ■ Anomaly detection

- [11] Maxim Makatchev and Daniel N. Neill. Learning outbreak regions in bayesian spatial scan statistics. In *Proceedings of ICML/UAI/COLT Workshop on Machine Learning for Health Care Applications*, Helsinki, Finland, July 2008.

## ■ Interaction design

- [12] Sandra Mau, Nik A. Melchior, Maxim Makatchev, and Aaron Steinfeld. BlindAid: An electronic travel aid for the blind. Technical report TR-07-39, Robotics Institute, Carnegie Mellon University, May 2008.

## ■ Symbolic and statistical NLP

- [13] Maxim Makatchev and Kurt VanLehn. Combining bayesian networks and formal reasoning for semantic classification of student utterances. In *Proceedings of the 2007 conference on Artificial Intelligence in Education: Building Technology Rich Learning Contexts That Work*, pages 307–314, Amsterdam, The Netherlands, The Netherlands, 2007. IOS Press.
- [14] Pamela W. Jordan, Maxim Makatchev, and Umarani Pappuswamy. Understanding complex natural language explanations in tutorial applications. In *Proceedings of the Third Workshop on Scalable Natural Language Understanding, ScaNaLU'06*, pages 17–24, Stroudsburg, PA, USA, 2006. Association for Computational Linguistics.
- [15] Pamela W. Jordan, Maxim Makatchev, Umarani Pappuswamy, Kurt VanLehn, and Patricia L. Albacete. A natural language tutorial dialogue system for physics. In *FLAIRS Conference*, pages 521–526, 2006.

- [16] Maxim Makatchev, Kurt VanLehn, Pamela W. Jordan, and Umarani Pappuswamy. Representation and reasoning for deeper natural language understanding in a physics tutoring system. In *FLAIRS Conference*, pages 682–687, 2006.
- [17] Maxim Makatchev, Brian S. Hall, Pamela W. Jordan, Umarani Pappuswamy, and Kurt VanLehn. Mixed language processing in the Why2-Atlas tutoring system. In *Proceedings of the Workshop on Mixed Language Explanations in Learning Environments, AIED2005*, pages 35–42, July 2005.
- [18] Pamela W. Jordan, Maxim Makatchev, and Umarani Pappuswamy. Relating student text to formal proofs: Issues of presuppositions and efficiency of expression. In *Proceedings of the Workshop on Mixed Language Explanations in Learning Environments, AIED2005*, pages 43–50, July 2005.
- [19] Maxim Makatchev and Kurt VanLehn. Analyzing completeness and correctness of utterances using an ATMS. In *Proceedings of Int. Conference on Artificial Intelligence in Education, AIED2005*. IOS Press, July 2005.
- [20] Maxim Makatchev, Pamela W. Jordan, and Kurt VanLehn. Modeling students' reasoning about qualitative physics: Heuristics for abductive proof search. In *Proceedings of Intelligent Tutoring Systems Conference*, volume 3220 of *LNCS*, pages 699–709, Maceió, Alagoas, Brazil, 2004. Springer.
- [21] Pamela W. Jordan, Maxim Makatchev, and Kurt VanLehn. Combining competing language understanding approaches in an intelligent tutoring system. In *Proceedings of Intelligent Tutoring Systems Conference*, volume 3220 of *LNCS*, pages 346–357, Maceió, Alagoas, Brazil, 2004. Springer.
- [22] Maxim Makatchev, Pamela W. Jordan, Umarani Pappuswamy, and Kurt VanLehn. Abductive proofs as models of students' reasoning about qualitative physics. In *ICCM*, pages 166–171, 2004.
- [23] Maxim Makatchev, Pamela W. Jordan, Umarani Pappuswamy, and Kurt VanLehn. Abductive proofs as models of students' reasoning about qualitative physics. In *Proceedings of the 18th International Workshop on Qualitative Reasoning*, pages 11–18, Evanston, Illinois, USA, 2004.
- [24] Pamela Jordan, Maxim Makatchev, and Kurt VanLehn. Abductive theorem proving for analyzing student explanations. In *Proceedings of International Conference on Artificial Intelligence in Education*, pages 73–80, Sydney, Australia, 2003. IOS Press.
- [25] Pamela Jordan, Maxim Makatchev, and Uma Pappuswamy. Extended explanations as student models for guiding tutorial dialogue. In *Proceedings of AAAI Spring Symposium on Natural Language Generation in Spoken and Written Dialogue*, pages 65–70, 2003.
- [26] Kurt VanLehn, Pamela Jordan, Carolyn Rosé, Dumisizwe Bhembe, Michael Böttner, Andy Gaydos, Maxim Makatchev, Umarani Pappuswamy, Michael Ringenberg, Antonio Roque, Stephanie Siler, and Ramesh Srivastava. The architecture of Why2-Atlas: A coach for qualitative physics essay writing. In *Proceedings of Intelligent Tutoring Systems Conference*, volume 2363 of *LNCS*, pages 158–167. Springer, 2002.

## ■ Robot modelling/control/interface

- [27] Maxim Makatchev and S. K. Tso. Human-robot interface using agents communicating in an xml-based markup language. In *Proc. of the IEEE Int. Workshop on Robot and Human Interactive Communication (RO-MAN)*, pages 27–29, 2000.

- [28] Maxim Makatchev, Sherman Y. T. Lang, S. K. Tso, and John J. McPhee. Cross-coupling control for slippage minimization of a four-wheel-steering mobile robot. In *Proc. of the 31st Int. Symposium on Robotics (ISR'2000)*, pages 42–47, 2000.
- [29] Maxim Makatchev, John J. McPhee, S. K. Tso, and Sherman Y. T. Lang. System design, modelling, and control of a four-wheel-steering mobile robot. In *Proc. of 19th Chinese Control Conference*, pages 759–763, 2000.

## ■ Complexity of picture language recognition

- [30] Maxim Makatchev and Sherman Y. T. Lang. On the complexity of image processing and pattern recognition algorithms. In *Proc. of the Int. Workshop on Image, Speech, Signal Processing and Robotics*, volume 1, pages 217–222, Hong Kong, China, September 1998.

---

### Service

#### Outreach

- 2013 Presenter, TechNights for middle school girls (CMU)
- 2009 Presenter, Andrew's Leap summer program for high school students (CMU)

#### Reviews and meeting organization

- 2013 Reviewer, Journal of Interaction Studies
- 2013 Reviewer, IEEE/RSJ Int. Conference on Intelligent Robots and Systems (IROS)
- 2013 Reviewer, International Conference on Human-robot Interaction (HRI)
- 2013 Reviewer, Fifth Workshop on Gaze in HRI
- 2012 Reviewer, International Conference on Social Robotics
- 2008, 2009 Co-organizer and reviewer, Human-Robot Interaction Young Researchers Workshop (in conjunction with ACM/IEEE HRI Conference)
- 2007 Reviewer, International Conference on AI in Education (AIED)
- 2005 Co-chair and reviewer, Workshop on Mixed Language Explanations in Learning Environments, in conjunction with Int. Conference on AI in Education (AIED)
- 2005, 2006 Reviewer, Conference of the Cognitive Science Society (CogSci)
- 2004 Reviewer, Journal of Automated Reasoning, special issue on Automated Reasoning and Theorem Proving in Education
- 2004 Reviewer, International Conference on Cognitive Modelling

---

### Other

- 8.2011–now DJ, “Russian Hour,” WRCT 88.3FM
- 2009 Captain, intramural tennis team (CMU championship runner-up)

---

### Natural languages

- Russian Mother tongue
- English Fluent
- Japanese Basic spoken and written